

REMARKS

Applicant concurrently files herewith an Excess Claim Fee Payment Letter for eleven (11) excess total claims.

Claims 1-31 are all of the claims presently pending in the application. Claims 1-2, 4, 7, 9, and 12-17 have been amended pursuant to local practices. Claims 18-31 have been added to claim additional features of the invention.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 1-17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yang et al. (U.S. Patent No. 5,563,424) (hereinafter "Yang").

This rejection is respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

The claimed invention (e.g., as defined by exemplary claim 1) is directed to an organic semiconductor device. The organic semiconductor device includes an organic semiconductor layer deposited between a first electrode and a second electrode that are facing each other. The first electrode and the second electrode are each made of materials having different work functions with respect to each other.

Conventional bottom-contact type and top-contact type MOS-TFTs have been designed using organic semiconductor layers. These structures include a gate electrode, a gate insulator layer, a source electrode, a drain electrode, and an organic semiconductor layer, which are all formed on a substrate. The organic semiconductor layer is made using pentacene or the like to enhance the carrier mobility to improve a working frequency of the organic transistor. Gold (Au) or palladium (Pd) are commonly used for both the source electrode and the drain electrode (see Application at page 2, lines 9-21).

The claimed invention of exemplary claim 1, on the other hand, provides an organic

semiconductor device where the first electrode and the second electrode are each made of materials having different work functions with respect to each other (e.g., see Application at page 2, line 26 through page 3, line 3). This allows the organic semiconductor device of the claimed invention to decrease the electron injection barrier between the drain electrode and the organic semiconductor layer, and the electron injection barrier between the source electrode and the organic semiconductor layer (see Application at page 5, lines 6-17).

III. THE PRIOR ART REFERENCE

The Examiner alleges that the claimed invention of claims 1-17 would have been obvious in view of Yang. Applicant submits, however, that there are elements of the claimed invention which are neither taught nor suggested by Yang, and that these elements would not have been obvious to one of ordinary skill in the art in view of Yang.

That is, Yang does not teach or suggest an organic semiconductor device, "*wherein the first electrode and the second electrode comprise materials having different work functions with respect to each other*" as recited in claim 1.

As noted above, unlike conventional semiconductor devices, the claimed invention provides an organic semiconductor device where the first electrode and the second electrode are each made of materials having different work functions with respect to each other (e.g., see Application at page 2, line 26 through page 3, line 3). This allows the organic semiconductor device of the claimed invention to decrease the electron injection barrier between the drain electrode and the organic semiconductor layer, and the electron injection barrier between the source electrode and the organic semiconductor layer (see Application at page 5, lines 6-17).

The Examiner alleges that "it is inherent, or alternatively obvious, that two different materials such as Al and Ca have different work functions". The Examiner attempts to rely on Figure 2 and column 8, lines 48-57 of Yang to support her allegations. The Examiner, however, is clearly incorrect.

That is, nowhere in this figure nor this passage (nor anywhere else for that matter) does Yang teach or suggest an organic semiconductor device where the first electrode and the second electrode are each made of materials having different work functions with respect to each other. Indeed, the Examiner merely alleges that Yang teaches a device having a first electrode made of Al and a second electrode made of Ca. The Examiner does not, however,

point to anywhere in the specification that teaches a first electrode and a second electrode each made of materials having different work functions with respect to each other.

Yang merely discloses a polymer grid triode having a first electrode (1), a second electrode (5), a first active material (2), a second active material (4) and a grid electrode (3) disposed between the first electrode and the second electrode (see Yang at Figure 1 and column 7, lines 45-54). Yang fails to even mention, let alone teach or suggest, a relationship between the work functions of the first electrode and the second electrode.

In fact, the Examiner merely alleges, as indicated above, that “it is inherent, or alternatively obvious, that two different materials such as Al and Ca have different work functions” (see Office Action at page 2, lines 15-17). Applicant respectfully submits, however, that it is known to those of ordinary skill in the art that the same material is used for both the drain electrode and the source electrode in a transistor, such as that disclosed in the Application.

Moreover, while Al and Ca may have different work functions, column 8, lines 53-57 indicate that the cathode can be formed from Ca or Al. Even assumed that the cathode is the claimed second electrode, there is no teaching or suggesting for providing a different material as the first electrode for the purpose of the invention.

The claimed invention recites a specific relationship that allows the claimed invention to decrease the electron injection barrier between the drain electrode and the organic semiconductor layer, and the electron injection barrier between the source electrode and the organic semiconductor layer. Applicants submit that this relationship would not have been obvious to those skilled in the art of organic semiconductor transistors in view of Yang. That is, Yang is not even directed to a transistor device. Yang merely discloses a polymer grid triode. Therefore, even if Yang discloses a cathode which can be made from either Al or Ca, Yang does not teach or suggest the non-obvious features recited in the claimed invention.

Moreover, the Examiner alleges that Yang teaches a device having an organic semiconductor layer. The Examiner alleges that the active material layers (2) and (4) of Yang teach an organic semiconductor layer, and attempts to rely on column 10, line 30 to support her allegations. The Examiner, however, is clearly incorrect.

That is, this passage of Yang merely discusses the materials used to form the polymer grid electrode (3). Yang teaches that the polymer grid electrode is fabricated from a network having a conducting polymer (see column 9, lines 34-36). In one embodiment for forming the

network including the conducting polymer, different concentrations of PANI:PES blends were prepared by mixing the PANI and the PES solutions at different ratios (see column 10, lines 16-30). Nowhere does this passage even mention the active material layers (2) and (4), let alone teach or suggest an organic semiconductor layer.

Moreover, with respect to claims 5-6 (and similarly claims 11-12) the Examiner states that "it would have been obvious to optimize the relevant work functions as set forth, in order to increase current injection and current flow" (see Office Action at page 2, lines 20-22). Applicant respectfully disagrees.

Applicant has discovered particular ranges, as recited in exemplary dependent claims 5 and 6 (and similarly recited in dependent claims 11 and 12) that achieve unexpectedly superior results. According to MPEP § 2144.05 "[a]pplicants can rebut a *prima facie* case of obviousness based on overlapping ranges by showing the criticality of the claimed range" (emphasis in MPEP). Such is clearly set forth in the Application.

As indicated above, the specific ranges recited in dependent claims 5 and 6 (and similarly recited in dependent claims 11 and 12) allow the organic semiconductor device of the claimed invention to decrease the electron injection barrier between the drain electrode and the organic semiconductor layer, and the electron injection barrier between the source electrode and the organic semiconductor layer. Also, as indicated above, these results would not have been obvious or expected because it is known to those of ordinary skill in the art that the drain electrode and the source electrode are made of the same material.

Therefore, Applicant submits that the claimed invention would not have been obvious in view of Yang. Therefore, the Examiner is respectfully requested to withdraw this rejection.

III. NEW CLAIMS

New claims 18-31 have been added to provide more varied protection for the claimed invention and to claim additional features of the invention. These claims are independently patentable because of the novel features recited therein.

Applicant respectfully submits that new claims 18-31 are patentable over any combination of the applied references at least for analogous reasons to those set forth above with respect to claims 1-17.

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IV. FORMAL MATTERS AND CONCLUSION


In view of the foregoing, Applicant submits that claims 1-31, all of the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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